APR 27 1928

Medical Lib.

Volume X APRIL, 1928 Number 4

THE JOURNAL OF INDUSTRIAL HYGIENE

AND ABSTRACT OF THE LITERATURE

Editor, United States
DAVID L. EDSALL, M.D., S.D.

Honorary Consulting Editor
SIR THOMAS M. LEGGE, M.D., D.P.H.

Editor, Great Britain
E. L. COLLIS, M.D., M.R.C.S.

Effects of Dust upon Coal Trimmers

Fatal Accidents from Electric Shock in Recent Years in the United States and Canada, in England and Wales, and in Switzerland

Recent Experience of the Public Utilities of the United States and Canada in the Use of the Schäfer Prone Pressure Method of Resuscitation in Cases of Electric Shock

Published at Mount Royal and Guilford Aves., Baltimore, Md.
by HARVARD SCHOOL OF PUBLIC HEALTH

Entered as second-class matter, at the Post Office at Baltimore, Maryland, under Act of March 3, 1879.
Copyright, 1928, by Harvard Medical School.

Made in United States of America

EDITORS

United States

DAVID L. EDSALL, M.D., S.D.

Great Britain

E. L. COLLIS, M.D., M.R.C.S.

HONORARY CONSULTING EDITOR

SIR THOMAS M. LEGGE, M.D., D.P.H.

ASSOCIATE EDITORS

United States

W. IRVING CLARK, JR., M.D.
LELAND E. COFER, M.D.
ALICE HAMILTON, A.M., M.D.
EMERY R. HAYHURST, A.M., Ph.D., M.D.
YANDELL HENDERSON, Ph.D.
HARRY E. MOCK, M.D.
L. R. THOMPSON, M.D.
C.-E. A. WINSLOW, M.S., A.M., Dr.P.H.
WILLIAM P. YANT, B.S.

Great Britain

W. F. DEARDEN, M.R.C.S., D.P.H.
SIR KENNETH GOADBY, K.B.E., M.R.C.S., D.P.H.
LEONARD HILL, M.B., F.R.S.
T. LISTER LLEWELLYN, B.S., M.D., M.I.M.E.
SIR THOMAS OLIVER, M.D.
R. PROSSER WHITE, M.D., M.R.C.S.
H. M. VERNON, A.M., M.D.
D. A. COLES, M.D.

South Africa

E. H. CLUVER, A.M., M.D., B.Ch., D.P.H.

Canada

J. J. R. MACLEOD, M.B.

Australia

H. W. ARMIT, M.R.C.S., L.R.C.P.

MANAGING EDITORS

CECIL K. DRINKER, M.D.

PHILIP DRINKER, B.S., Ch.E.

MARION C. SHORLEY

THE JOURNAL OF INDUSTRIAL HYGIENE

VOLUME X APRIL, 1928 NUMBER 4

EFFECTS OF DUST UPON COAL TRIMMERS*

EDGAR L. COLLIS, D.M.

Talbot Professor of Preventive Medicine, University of Wales

AND

J. C. GILCHRIST, M.D.

Tuberculosis Physician, Welsh National Memorial Association

INTRODUCTION

DUST inhalation is a predisposing cause to such respiratory diseases as asthma, pneumonia, bronchitis, and tuberculosis, which, when they are so caused, are known as pneumonokonioses. Different dusts when inhaled react differently with the tissues. Practically all dusts which cause any trouble predispose to bronchitis and, if the particles are small enough to enter the minute bronchioles and alveoli, to pneumonia as well. Hence the presence of any excess of bronchitis and pneumonia in any group exposed to dust inhalation should raise the suspicion that the dust is injurious.

Only one dust, that of free silica, SiO_2, in addition to predisposing to bronchitis and pneumonia, is definitely known to exert a specific action in predisposing to tuberculous infection.

In direct contrast to silica, which is the most potent instigator of the pneumonokonioses, stands the dust of coal; occupationally more persons are exposed to this dust than to any other. In Great Britain alone a million workers go below ground daily; while another 250,000 are only less exposed to coal dust working at collieries, on the surface. After agriculture, coal mining is the most important of industries and employs most persons.

In addition to coal mining, the transport of coal exposes further groups of men to coal dust, and, in particular, coal trimmers when filling

*Received for publication Nov. 24, 1927.

ships' bunkers and cargo holds. The influence exerted by coal dust has been claimed to be rather beneficial to health than otherwise. One reason advanced is that coal miners as a class are found all the world over with an unusually low mortality from pulmonary tuberculosis. The importance of this fact is not lessened by the occurrence of silicosis and tuberculosis among one small group of the coal mining fraternity who sink shafts and drive roads through sandstone rocks, studied by Tattersall (1) and Cummins (2); on the contrary the low incidence of tuberculosis among all other groups of coal miners stands out in greater contrast. Efforts, by animal experiments, have been made to throw light on the position. Coal dust, according to Haldane and others, is picked up by macrophage cells from the alveoli more readily than most other dusts; while preliminary inhalation of coal dust, according to Mavrogordato (3), seems to interfere with the usual action of silica dust. But doubt may be expressed as to whether necessity exists to seek for an explanation of the low phthisis mortality of coal miners outside the fact that miners work so far apart as to reduce the opportunities for spreading, and for being exposed to infection during working hours, to at least the minimum prevailing among agriculturists. Coal miners on certain British coal fields, particularly in Lancashire and South Wales, experience unusually high mortalities from respiratory diseases, such as pneumonia and bronchitis; some proportion, at least, of these mortalities has been attributed to dust inhalation (4).

Mortality Records

The investigation now reported is concerned particularly with coal trimmers employed in the docks at Cardiff in South Wales. The work of these men exposes them for long periods in semiclosed spaces in the holds of ships to dust arising from South Wales coal.

Coal Trimmers.—The secretary of the Coal Trimmers' Union placed at our disposal information contained on the death certificates of 426 members who died between 1910 and 1926, inclusive. From this information Table 1 has been prepared which shows the proportionate mortality experienced at various ages (*a*) by coal trimmers and, for comparison, (*b*) by all males in England and Wales, 1910 to 1912. A survey of this table suggests that coal trimmers die rather less than the standard from phthisis; about the same from cancer and from circulatory diseases; but distinctly and definitely more than the standard from bronchitis and even more still from pneumonia. Owing, however, to the small number of deaths concerned, even though the indications run true from age period to age period, absolute reliance on the proportions given should not be insisted upon.

Coal Heavers.—Consideration should first be given to collateral evidence such as that provided by the Registrar-General in information published with regard to the group, coal heavers, 1910 to 1912. Information from this source is presented in Table 2. A survey suggests that the coal heavers die at about the same rate as the standard from phthisis, cancer,

and circulatory diseases; at a rather higher rate from bronchitis; and at a decidedly higher rate from pneumonia.

deaths from pneumonia to represent a comparative figure of 116 as compared with 66 for all males.

TABLE 1.—DEATHS AMONG (A) CARDIFF, PENARTH AND BARRY COAL TRIMMERS' UNION, 1910 TO 1926, AND (B) ALL MALES, ENGLAND AND WALES, 1910 TO 1912. PERCENTAGES OF ALL DEATHS AT CERTAIN AGE PERIODS DUE TO CERTAIN CAUSES

CAUSE		AGE PERIOD					
		25–	35–	45–	55–	65–	75 and over
Phthisis	A	8.3	12.3	16.2	7.3	4.2	0.0
	B	35.4	26.1	15.6	7.3	2.2	0.3
Cancer	A	0.0	5.3	15.3	13.8	10.5	15.8
	B	2.3	5.4	11.5	14.4	12.0	6.0
Diseases of heart and circulation	A	25.0	15.8	11.4	12.3	14.8	10.5
	B	7.7	11.6	25.5	19.7	21.3	15.1
Bronchitis	A	0.0	7.0	12.3	21.7	26.3	36.8
	B	1.1	2.3	4.5	8.1	11.5	12.7
Pneumonia	A	58.4	22.8	15.3	14.5	10.5	5.3
	B	9.8	9.9	8.5	7.0	5.0	3.0
Other respiratory diseases	A	0.0	1.7	3.8	3.6	3.2	0.0
	B	1.2	1.7	2.1	2.2	2.0	1.7
All other diseases	A	8.3	35.1	25.7	26.8	30.5	31.6
	B	42.5	43.0	32.3	41.3	46.0	61.2
All causes		100.0	100.0	100.0	100.0	100.0	100.0
Total deaths of coal trimmers		12	57	105	138	95	19

These indications closely resemble those already deduced from examination of the coal trimmers' deaths.

In the case of the coal heavers the suggestions derived from proportionate mortality can be compared with definite comparative mortality figures; when the excess deaths from bronchitis are found to represent a comparative mortality figure of 54 as against one of 38 for all males, and the excess

Additional information for the years 1921 to 1923, issued while this article was in press and summarized in Table 3, again exhibits men exposed to coal dust with high mortalities from bronchitis, and, so far as coal boat loaders and dischargers are concerned, with an excessive mortality from pneumonia.

Appeal to mortality statistics seems then to establish that so far as coal heavers and coal trimmers are con-

TABLE 2.—PERCENTAGES OF ALL DEATHS AT CERTAIN AGE PERIODS DUE TO PULMONARY DISEASES AMONG CERTAIN OCCUPATIONAL GROUPS EXPOSED TO COAL DUST, FOR THE YEARS 1910 TO 1912, ENGLAND AND WALES

OCCUPATIONAL GROUP	AGE PERIOD				
	25–	35–	45–	55–	65–75
Phthisis					
All males	35.4	26.1	15.6	7.3	2.2
All coal miners	19.0	15.3	10.6	4.8	1.4
South Wales coal miners	14.5	13.9	9.2	4.8	1.5
Coal heavers	29.0	28.8	14.9	7.9	1.9
Bronchitis					
All males	1.1	2.3	4.5	8.1	11.5
All coal miners	0.7	2.6	5.7	12.4	18.0
South Wales coal miners	0.9	2.7	6.8	14.7	21.4
Coal heavers	2.2	3.0	5.1	9.2	13.9
Pneumonia					
All males	9.8	9.9	8.5	7.0	5.0
All coal miners	9.2	9.4	9.8	7.8	5.4
South Wales coal miners	10.5	9.7	8.8	8.0	5.7
Coal heavers	13.0	11.8	14.6	9.8	6.6
Other Respiratory Diseases					
All males	1.2	1.7	2.1	2.2	2.0
All coal miners	0.9	1.6	2.1	3.0	2.3
South Wales coal miners	1.2	1.5	3.5	4.7	3.4
Coal heavers	1.5	1.1	2.6	1.8	1.5

TABLE 3.—COMPARATIVE MORTALITY FIGURES FOR PULMONARY DISEASES AMONG CERTAIN OCCUPATIONAL GROUPS EXPOSED TO COAL DUST, FOR THE YEARS 1921 TO 1923, ENGLAND AND WALES

OCCUPATIONAL GROUP	PHTHISIS	BRONCHITIS	PNEUMONIA
All occupied and retired males	163.5	49.6	85.1
All coal miners	123.4	73.8	90.8
Coal boat loaders and dischargers	166.4	98.3	163.7

cerned, exposure to the inhalation of coal dust is associated with an unduly high mortality from pneumonia and also from bronchitis, but not with a high mortality from phthisis.

Other conditions of work may, how-

ever, predispose to these respiratory diseases; thus work before furnaces at high temperatures with exposure, while returning home through cold winds, in clothes damp with sweat, may be quoted as an instance in point. Further evidence as to the influence exerted by dust is, however, forthcoming from clinical and radiographic examinations of a number of coal trimmers coming by chance under observation through attendance at the Cardiff tuberculosis dispensary.

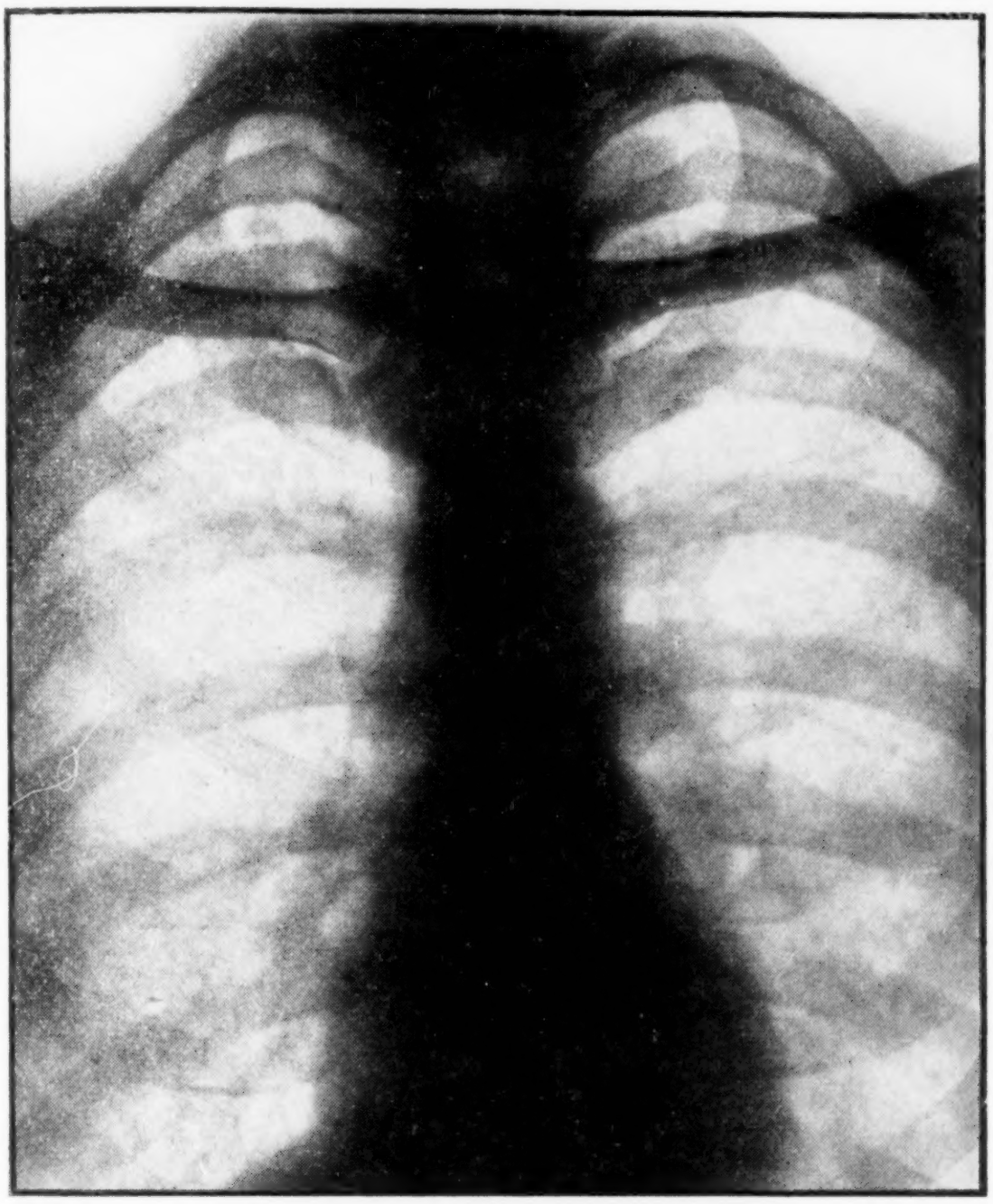

FIG. 1.—Case 1. Showing fine even mottling over both lungs. Sputum had been blood streaked for three or four years but was twice negative for tubercle bacilli.

Cancer Records.—Before passing on to this evidence, however; attention may be directed to the distribution according to parts affected of the fifty-one cases of cancer. An undue proportion, eleven, or 22 per cent., were due to cancer of the skin, in contrast to 3.3 per cent. of all cases of cancer among males in England and Wales in 1925. The parts of the body affected were, neck (5), penis (3), cheek (1), rodent ulcer (temporal) (1), rodent ulcer (site not stated) (1).

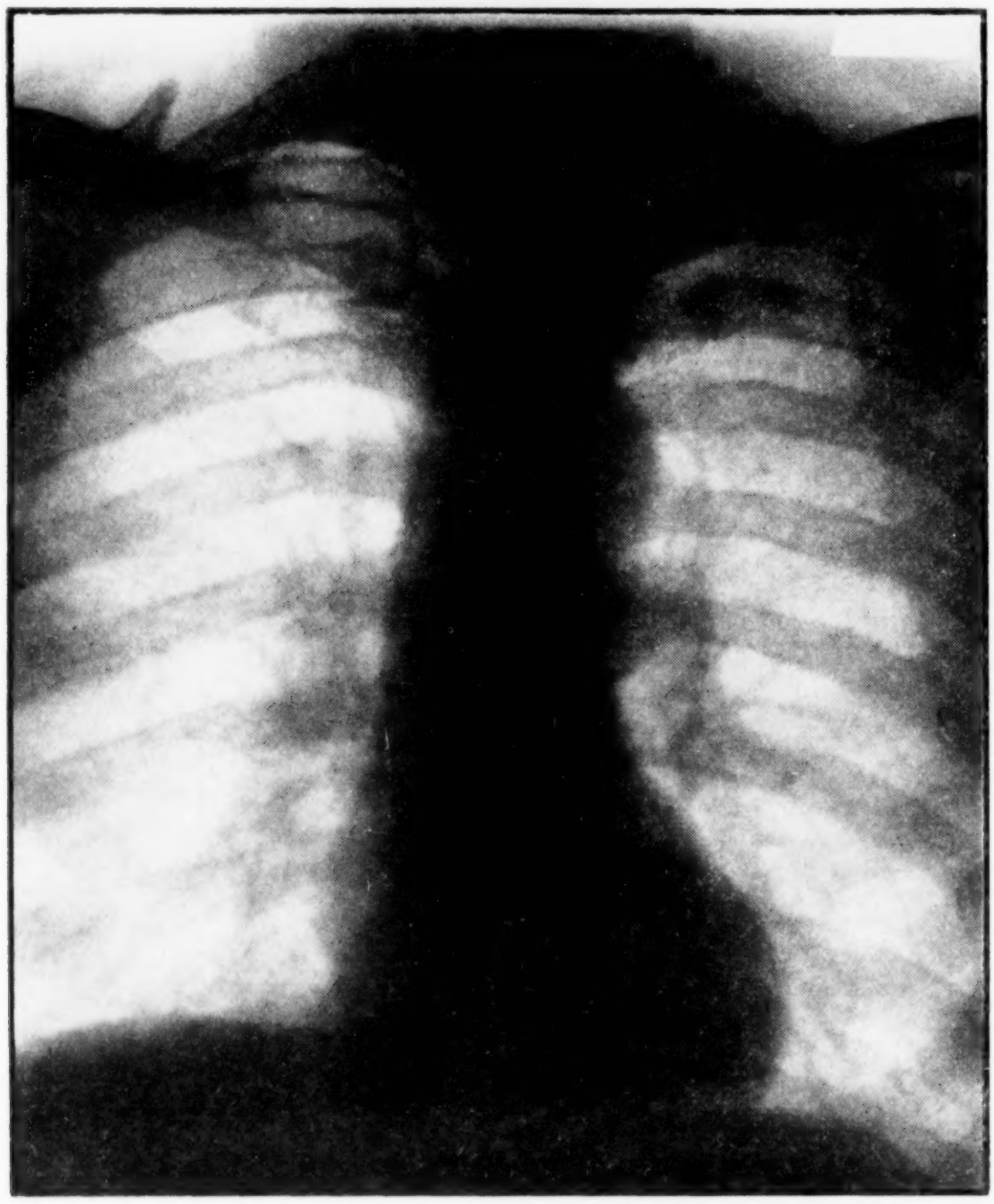

FIG. 2.—Case 2. Showing fine close mottling throughout both lungs. Sputum on two occasions was blood streaked; was three times negative for tubercle bacilli.

of the penis (5, p. 35); the number of times the skin of the neck was concerned is unusual. On the other hand cancers of the group, peritoneum, intestines, and rectum, which usually account in males for about 23 per cent. of all cases, in the present series amounted to only three, or 6 per cent.; this fact, so far as the rectum is concerned, is confirmatory of previous observation (5, p. 43).

Clinical Evidence.—The case records at the tuberculosis dispensary for the last three years include a group of eleven coal trimmers, all exhibiting certain interesting phenomena. Since the cases came to the dispensary as patients suspected of pulmonary tuberculosis, the condition of the chest had received particular attention.

The notes of three of these cases are here given together with characteristic radiographs.

CASE 1.—C. E., a coal trimmer, aged [illegible] was examined June 17, 1926. He had [illegible]

off work for seven weeks. His weight was deficient by 2 stones.

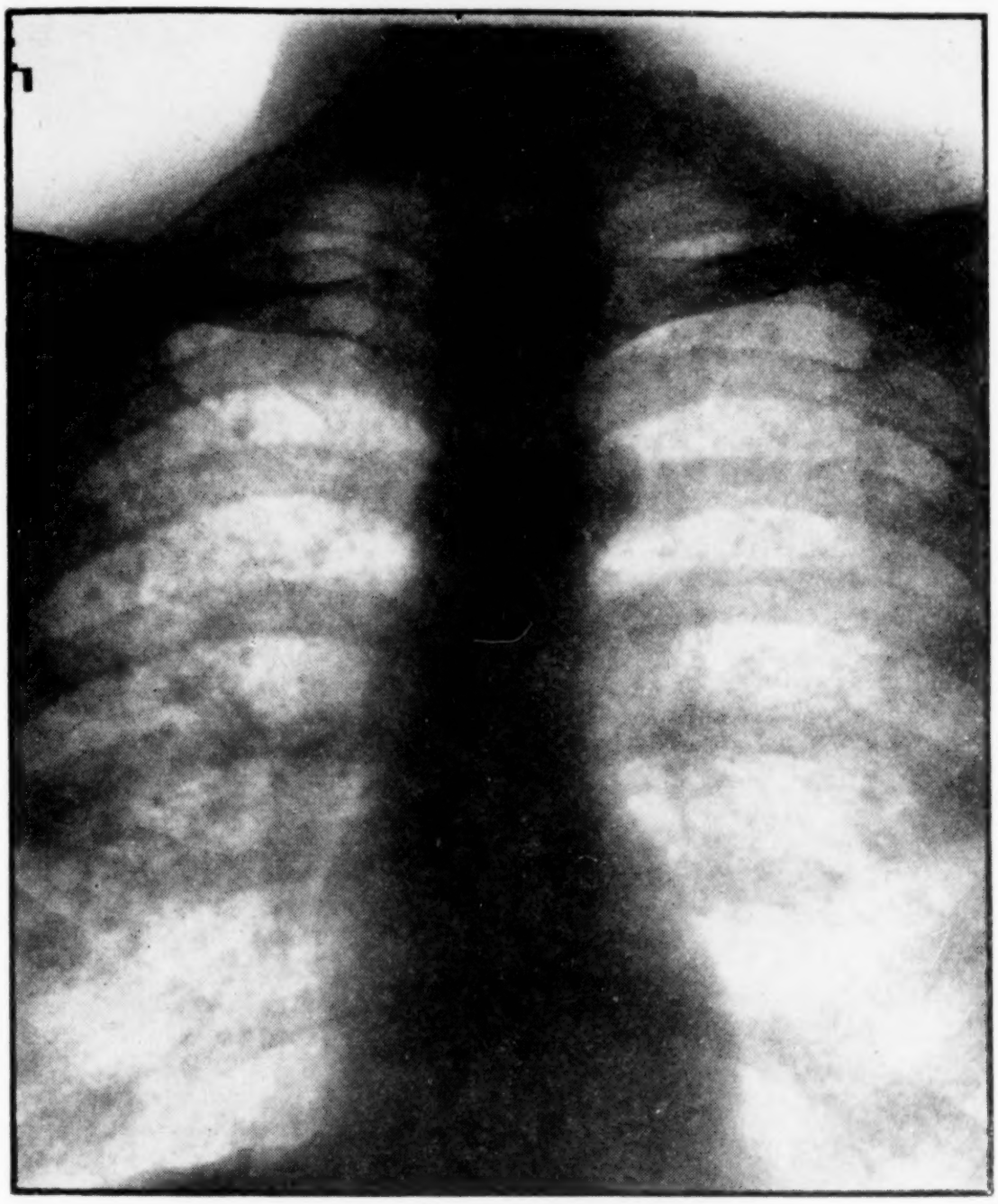

FIG. 3.—Case 3. Showing dense mottling throughout both lungs. Sputum was five times negative for tubercle bacilli.

Family History.—No history of tuberculosis was obtained.

Personal History.—He was invalided in 1915 on account of "shell shock" with tachycardia (from Suvla Bay). He has a history of blood streaked sputum, recurrent for three or four years; he has experienced cough for the last six weeks with dyspnea and pain in the chest.

Physical Signs.—There is slight impairment of the percussion note at the right apex; the general condition is very fair.

Sputum.—The sputum was twice negative for tubercle bacilli.

X-Ray.—A fine even mottling is shown over both lungs. (See Fig. 1.)

CASE 2.—J. R., a foreman coal trimmer, aged 57, was examined Aug. 17, 1926. He was still at work. His weight was deficient by nearly 2 stones.

Family History.—No history of tuberculosis was obtained.

Personal History.—He has had occasional bronchitis, but the cough always cleared quickly until he sustained an injury to his shoulder, clavicle, and ribs, from a fall six months ago. He has had a slight cough and sputum since this, and on two occasions the sputum has been streaked with blood. He has experienced slight lassitude and dyspnea, with slight subcutaneous "soreness" under the left breast, and a heavy pain in the lower left axilla.

Physical Signs.—The chest is flat, with

fair expansion which is slightly delayed on the left side. The percussion note is impaired on both clavicles and at the bases; posteriorly occasional râles are heard at the right anterior base. Fine crepitations are detected with increased vocal resonance at the left anterior base.

Sputum.—The sputum was three times negative for tubercle bacilli.

X-Ray.—Fine close mottling is to be seen throughout both lungs. (See Fig. 2.)

Case 3.—H. O., a coal trimmer, aged 54, was examined June 8, 1925. He had been off work for five months. His weight was 19 pounds below average.

Family History.—No history of tuberculosis was obtained.

Personal History.—He has had winter cough with dyspnea for the last two years. Six months ago he had a pain in the left side and lately has suffered from bronchitis.

Physical Signs.—The air entry is deficient generally; a few clicks are heard within the left scapula. Twelve months later the clinical condition was unaltered.

Sputum.—The sputum was five times negative for tubercle bacilli.

X-Ray.—Dense mottling is to be seen throughout both lungs. (See Fig. 3.)

Tubercle bacilli were detected in the sputum from only one case out of the eleven, even though the sputum was examined five times in two cases, four times in two cases, three times in two cases, twice in two cases, and once in one case, while no sputum was available in the eleventh case. Nevertheless a history of blood in the sputum was obtained in eight cases, including the one with tubercle positive sputum. Only two cases had clubbed fingers, and only in the case which was positive for tubercle bacilli was the pulse rate over 84.

Radiography directed attention to this group of cases. The remarks after X-ray examination entered on the notes of the cases not already given above, together with details regarding weight, were as follows:

Case 4.—A. S. C., aged 46, was examined Oct. 20, 1926.

Weight was 9 pounds below best.

X-Ray.—Fairly dense flocculent mottling is seen over both lungs but is more marked on the left; the apices are clear, the costal cartilages show calcification.

Case 5.—J. L. I., aged 53, was examined Sept. 19, 1927.

Weight was 3 stones below average.

X-Ray.—The hilum shadows are extensive, with excessive arborescent shadows generally. There is no mottling.

Case 6.—J. H. V., aged 44, was examined June 8, 1925.

Weight was 5 pounds below normal.

X-Ray.—General mottling is seen; and extensive fairly dense shadows suggest a radial or stellate arrangement from several centers. The shadows may indicate pleural adhesions, but the interpretation is obscure.

Case 7.—J. E. P., aged 50, was examined Sept. 23, 1927.

Weight was 18 pounds below normal.

X-Ray.—The left side is fluffy; there is mottling generally. The right mediastinum is pulled over and the diaphragmatic pleura is raised in a peak. Dense shadows appear at a level of the second and third costal cartilages extending along their margins: above this faint mottling is shown: below a dense shadow continues downward filling most of the outer part of the lower lobe meeting the diaphragmatic pleura.

Case 8.—H. T., aged 55, was examined Sept. 2, 1927.

Weight was 20 pounds below normal.

X-Ray.—A very broad mediastinal shadow is seen with dense massive bilateral shadows in mid-zone. The condition is difficult to interpret.

Case 9.—E. T., aged 44, was examined Aug. 15, 1927.

Weight was 21 pounds below normal.

X-Ray.—Shadows indicative of calcified glands are seen at the left hilum. Extensive reticular shading appears over both lungs but there is no definite mottling.

Case 10.—D. G., aged 58, was examined Aug. 8, 1927.

Weight was 2 stones below normal.

X-Ray.—Extensive mottling is seen except at the left base. There is an extraordinarily dense shadow at the right hilum.

CASE 11.—L. L., aged 55, was examined Oct. 15, 1925.

Weight was about normal.

X-Ray.—Rather fine snowflake mottling is seen throughout both lungs, denser in the mid-zone on the right. There are also irregular shadows suggesting pleural thickenings.

The impression gathered from examining these radiographs is similar to, if not identical with, that obtained from examining radiographs of men exposed to a recognized silica dust risk and belonging to an occupational group with an excessive mortality from phthisis.

The condition is one of some interest; not only is it apparently not due to exposure to silica dust, but mortality records do not indicate the presence of any undue prevalence of phthisis among coal trimmers. Yet the lung shadows are not normal and would be quite compatible with exposure to silica dust risk; they are in accord with the undue tendency, disclosed by the death certificates, to succumb to pneumonia and bronchitis—diseases which are, indeed, always unduly fatal among those exposed to silica dust. The rarity of pulmonary tuberculosis among a group with lungs giving such radiographs is notable, and calls for care in interpreting radiographs.

DISCUSSION

These cases are reported as examples in support of an opinion we have been slowly forming after examining radiographs of men occupied in a variety of dusty trades, only some of which present a silica dust risk.

Just as a blue line on the gums is of the greatest help in detecting lead absorption when a worker is known to be exposed to a lead risk, so a "snowstorm" radiograph is of the greatest help in detecting silicotic fibrosis when a worker is known to be exposed to a silica dust risk. But a blue line on the gums may be caused by other things than lead and so is not absolutely diagnostic of lead absorption, particularly not when knowledge is lacking of any exposure to a lead risk. Just so a "snowstorm" radiograph may be caused by inhaling other dusts than silica, and is not absolutely diagnostic of silicotic fibrosis, particularly not when knowledge is lacking of any exposure to a silica dust risk.

When compensation for silicosis is under consideration, the foregoing conclusion is of some import.

SUMMARY

1. Statistical evidence is presented which indicates that men exposed to coal dust tend to succumb in excess from bronchitis and pneumonia, but not from phthisis. These tendencies are pronounced for coal trimmers in South Wales.

2. Coal trimmers seem to sustain an undue amount of cancer of the skin.

3. Clinical observation by X-ray examination discloses that, after years of work, the lungs of coal trimmers are not normal, and exhibit signs similar to those widely regarded as characteristic of silicotic fibrosis.

BIBLIOGRAPHY

1. Tattersall, N.: The Occurrence and Clinical Manifestations of Silicosis among Hard Ground Workers in Coal Mines. This Jour., 1926, *8*, 466.
2. Cummins, S. L.: Effects of Coal Dust upon the Silicotic Lung. Jour. Path. and Bacteriol., 1927, *30*, 615.
3. Mavrogordato, A.: Contributions to the Study of Miners' Phthisis. So. African Inst. Med. Res., Pub. No. 19. Johannesburg, Dec., 1926.
4. Collis, E. L.: A Study of the Mortality of Coal Miners, England and Wales. This Jour., 1922–1923, *4*, 310.
5. Young, M., and Russell, W. T., with Brownlee, J., and Collis, E. L.: An Investigation into the Statistics of Cancer in Different Trades and Professions. Med. Res. Council, Special Rep. Series No. 99. London, H. M. Stationery Office, 1926.

FATAL ACCIDENTS FROM ELECTRIC SHOCK IN RECENT YEARS IN THE UNITED STATES AND CANADA, IN ENGLAND AND WALES, AND IN SWITZERLAND*

THE purpose of this report is to present the statistics of electric fatalities in the United States and Canada and to compare our conditions with those of Switzerland and of England and Wales. Switzerland is chosen because it seems to offer a fairly close parallel to the United States, in so far as the development and utilization of electric power is concerned. It is also interesting to compare conditions in Switzerland, the United States, and Canada with those in England and Wales, where the use of electricity and of high tension transmission lines and electric power stations is not so fully developed.

Our data were taken from the published annuals of the United States Census Bureau, the Statistical Bureau of the Metropolitan Life Insurance Company,[1] the annual reports of the Registrar-General for England and Wales, and published data of the Schweizerischer Elektrotechnischer Verein (Zurich). The more general data are summarized in Table 1 and shown graphically in Figure 1.

The rates of both the United States and Switzerland are decidedly higher than those of England and Wales, and the rates of the United States registration area are slightly and significantly higher than those of Switzerland. For the United States, the average rate for the fourteen years (1911 to 1924) is 0.9 per 100,000 and for Switzerland, 0.7 per 100,000. The average difference between the two countries is 0.2 ± 0.06 per 100,000. There is no trend in the rates for the fourteen-year period in any of the countries, in spite of the increase in the use of electric power in the period. This suggests that both the deaths and the use of electricity have increased with the population in a constant ratio. If the use of electricity has increased more than the population, however, then it would seem that the methods employed to prevent accidents have been increasingly more effective over the period in question. The series vary from year to year slightly more than they should by chance.[2] This suggests that for Switz-

* A Report by the Engineering Committee of the Conference on Electric Shock:
Cecil K. Drinker
Oscar H. Fogg
Arthur E. Kennelly
John W. Lieb
Wills Maclachlan
Charles B. Scott
Louis A. Shaw
Robert M. Thomson
Philip Drinker, Chairman.
Received for publication Jan. 12, 1928.

[1] Courtesy of Mr. E. W. Kopf.

[2] The coefficient of disturbancy (an index of the variation in excess of that due to chance) for the United States is about 9.5 per cent. and for Switzerland about 16 per cent. Probably the two do not differ from each other significantly, but probably both (and certainly the United States) differ from zero significantly.

erland the methods of control of mortality from this industrial hazard have eliminated more fully all contributory factors, except that of human fallibility, than have the methods of control in the United States. It is likely, however, that there is room for *small* improvement in the control of mortality in both countries.

TABLE 1.—ELECTRIC FATALITIES (EXCEPT LIGHTNING) FROM 1911 TO 1924, INCLUSIVE

YEAR	UNITED STATES AND CANADA[1]		UNITED STATES		ENGLAND AND WALES		SWITZERLAND[2]	
	No. of Deaths	Death Rate per 100,000	No. of Deaths	Death Rate per 100,000	No. of Deaths	Death Rate per 100,000	No. of Deaths	Death Rate per 100,000
1911	60	0.8	513	0.9	..	....	25	0.7
1912	72	0.9	567	0.9	23	0.06	25	0.7
1913	85	1.0	670	1.1	22	0.06	20	0.5
1914	69	0.7	553	0.8	20	0.05	18	0.5
1915	66	0.7	515	0.8	29	0.08	19	0.5
1916	100	1.0	586	0.8	34	0.09	25	0.7
1917	78	0.7	654	0.9	24	0.06	25	0.7
1918	115	1.0	754	0.9	40	0.11	38	1.0
1919	115	0.9	748	0.9	32	0.08	29	0.8
1920	117	0.9	822	0.9	26	0.07	42	1.1
1921	112	0.8	741	0.8	19	0.05	25	0.6
1922	107	0.8	842	0.9	22	0.04	29	0.7
1923	106	0.7	945[3]	1.0[3]	25	0.06	23	0.6
1924	134	0.9	977[3]	1.0[3]	38	0.09	26	0.7

[1] Weekly premium plan of the Industrial Department, Metropolitan Life Insurance Company, New York.

[2] Swiss population taken from Pearl, R.: Studies in Human Biology. Baltimore, Williams & Wilkins Co., 1924.

[3] United States registration states.

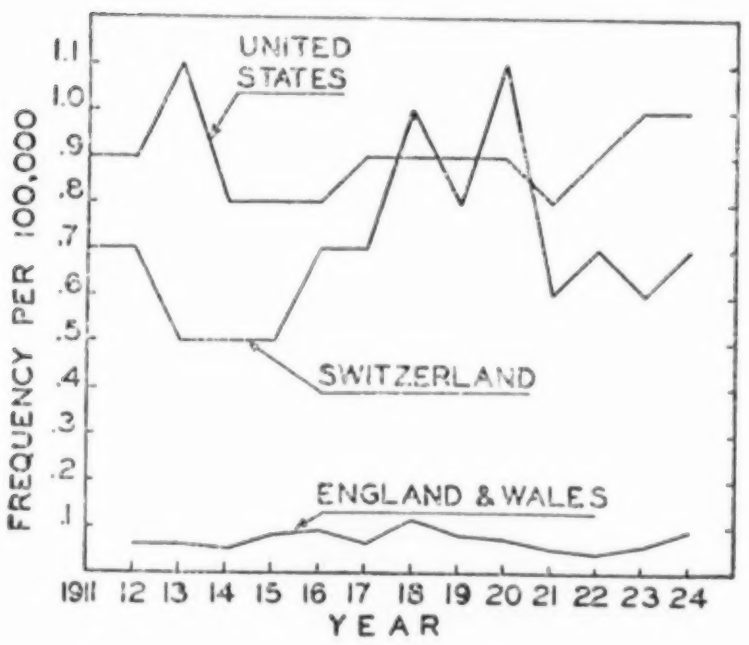

FIG. 1.—Fatal accidents from electricity (except lightning) from 1911 to 1924, inclusive, in the United States, Switzerland, and England and Wales.

The disparity between the figures for the United States and those for England and Wales is explainable, in part at least, by the fact that there is a much greater use of electricity, per capita, in the United States; consequently, as has been pointed out, there are more high tension generating stations and, in terms of percentage of total population, more persons exposed to hazards from electricity. Yet this explanation alone is not sufficient to account for the difference in

the figures. As to the disparity between the Swiss and the English figures, the Swiss conditions are probably more like those in the United States, and the Swiss accidental death rate from electricity is but little better than that of the United States.

umns II and IV, multiplying by 100, and dividing by Column VIII. They apply, therefore, to employees or members of the staff of the Swiss public utilities, whereas the figures for the United States and Canada obtained from the Metropolitan Life Insurance Company apply to employees of the public utilities and to any others whose occupation was given on their death certificates as "electrician," "electric lineman," etc.

TABLE 2.—ELECTRIC INJURIES AND FATALITIES IN SWITZERLAND, FROM DATA PUBLISHED BY THE SCHWEIZERISCHER ELEKTROTECHNISCHER VEREIN (ZURICH)

YEAR	I	II	III	IV	V	VI	VII	VIII	IX
	STAFF EMPLOYEES		EMPLOYEES NOT ON STAFF		OTHER PERSONS INCLUDING CONSUMERS		TOTAL		TOTAL ACCIDENTS
	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	
1911	11	7	5	5	10	13	26	25	51
1912	9	5	10	12	2	8	21	25	46
1913	13	6	19	10	1	4	33	20	53
1914	6	6	5	2	7	10	18	18	36
1915	4	5	4	6	2	8	10	19	29
1916	3	3	10	16	1	6	14	25	39
1917	8	5	8	8	14	12	30	25	55
1918	9	10	6	17	3	11	18	38	56
1919	6	8	11	9	7	12	24	29	53
1920	14	10	15	13	19	19	48	42	90
1921	11	8	17	3	13	14	41	25	66
1922	20	9	10	8	9	12	39	29	68
1923	10	3	16	6	16	14	42	23	65
1924	3	5	16	6	16	15	35	26	61

Table 2 gives the Swiss electric accident figures in greater detail and Table 3, which gives the Swiss statistics and those from the United States and Canada (from the Metropolitan Life Insurance Company's data), indicates by years what percentage of the fatalities are "occupational." The Metropolitan's figures apply to all industries and to all persons whose occupation involves regular or frequent exposure to electric current (of all voltages). The Swiss occupational deaths, on the other hand, were obtained from Table 2, by adding Col-

In Table 2, the percentage of total accidents which resulted in death (Column VIII divided by Column IX) varies from year to year around an average of 50. This variation is probably significantly greater than that due to chance. The coefficient of disturbancy is 16 per cent., the average annual percentage killed for the staff employees (Column II divided by

Columns I + II) is 44 and is not significantly different from the average of 50 for the total. The variation of the percentages from year to year, however, is different, the coefficient of disturbancy being imaginary. This fact seems to indicate that the methods of control are more effective upon staff employees than upon others, on account of the familiarity of staff employees with the administration and efficacy of resuscitation measures, and that further efforts to control mortality should be directed to the education of the general public in the proper methods of resuscitation. The figures for the United States which would throw further light upon these indications are, unfortunately, not available.

TABLE 3.—"OCCUPATIONAL" DEATH RATES FROM ELECTRICITY (LIGHTNING EXCEPTED) IN THE UNITED STATES AND CANADA, AND IN SWITZERLAND

YEAR	PERCENTAGE OF TOTAL DEATHS OF OCCUPATIONAL ORIGIN	
	United States and Canada[1]	Switzerland[2]
1911	..	48
1912	82	68
1913	67	80
1914	64	44
1915	49	58
1916	50	76
1917	69	52
1918	73	71
1919	76	59
1920	77	55
1921	78	44
1922	82	59
1923		39
1924		42

[1] Weekly premium plan of the Industrial Department, Metropolitan Life Insurance Company, New York—white males, 15 years and over.

[2] From Table 2, Columns II + IV × 100, divided by Column VIII.

In Figure 2 we have illustrated graphically the data from Table 3, supplemented by the Swiss nonfatal accident figures (from Columns I, III, and VII, Table 2). It is interesting to find that the electric accidents and deaths show such clear parallelism.

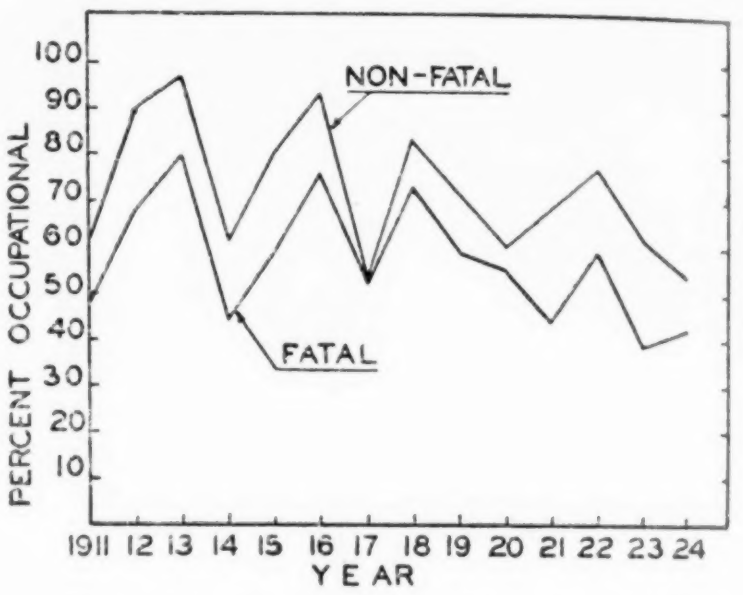

FIG. 2.—Comparison of occupational fatal and nonfatal accidents from electricity (except lightning) from 1911 to 1924, inclusive, in Switzerland.

The data in Table 4 are compiled from accident figures assembled by one of us (J. W. L.) and by Mr. S. E. Whiting, Chairman of the Electrical Committee of the American Society of Safety Engineers. This list is incomplete but the instances reported are authentic. We give the list in order to show that fatal accidents from low voltage circuits like those used for household lighting not only are possible but actually occur. The possibility of the occurrence of such accidents is being steadily reduced by

stringent building regulations and by the education of the public. At the same time, new risks are occasioned by the introduction of devices like the radio and by the increased use of electrical household appliances.

Since in the United States and Canada we use 110-volt circuits (usually alternating current) as the standard for household lighting and the British use 220-volt circuits, we are at some advantage on this continent, where voltages of that order are generally used only in power and industrial circuits.[3]

Discussion

If we extrapolate the fatality curve for the United States (Fig. 1) to 1926 and use Pearl's[4] estimate of 115,000,000 for the population of the United States in 1926, our total deaths from electricity in 1926 will amount to about 1,035. In Table 5 we have given, for comparison, the death rates from seven other sources of accident. Of these the first four are distinctly occupational and we should, therefore, know the number of men exposed to the hazards, rather than the total population, in order properly to evaluate their magnitude, but these figures are lacking. The next three sources are probably, like the electric hazard, fairly well distributed over the entire population, and their occupational element is of about the same relative importance as that of the electrical industry. Judged by death rates, then, the electric hazard is not excessive.

[3] Jackson, J. P.: Elementary Outline of Some of the Principles and Practices of the Electric Power Industry as Related to Safety. This Jour., 1927, *9*, 520.

[4] Pearl, R.: Studies in Human Biology. Baltimore, Williams & Wilkins Co., 1924.

TABLE 4.—FATAL ACCIDENTS IN THE UNITED STATES FROM LOW VOLTAGE (110–550) CIRCUITS

PERIOD	VOLTAGE							TOTAL CASES
	Uncertain	110	120	220	250	440	550	
1918–1926	5	14	3	10	2	8	10	52
1912–1919	13 ("lighting circuit")	14		..	..	..	..	27

TABLE 5.—DEATH RATES FROM CERTAIN ACCIDENTAL CAUSES (SOME REPRESENTING INDUSTRIAL HAZARDS), UNITED STATES REGISTRATION AREA FOR 1920

CAUSE	DEATH RATE PER 100,000
Absorption of deleterious gases (168)	3.4
Traumatism in mines (173 A)	2.5
Traumatism in quarries (173 B)	0.1
Traumatism by machines (174)	2.5
Railroad accidents and injuries (175 A)	7.3
Street car accidents and injuries (175 B)	2.0
Automobile accidents and injuries (175 C)	10.4
Electricity (lightning excepted)	0.9

Conclusion

In the light of the facts now available on fatal accidents from electricity, it is recommended that attempts to reduce these electric fatalities shall proceed along the following lines:

1. Education of the general public in precautionary measures and in the importance of using only first-class electrical household equipment. Any sort of equipment can now be plugged into electrical outlets, although the actual wiring is somewhat controlled by building, fire, and insurance regulations.

2. Continued education of the employees of the electrical industries themselves by the methods already in force.

3. Development of methods of resuscitation for cases of cardiac failure as well as for cases of purely respiratory failure.

We are indebted to Dr. Carl R. Doering, Department of Vital Statistics, Harvard School of Public Health, for many helpful comments and suggestions in the preparation of this Report.

J. I. H.
April, 1928

RECENT EXPERIENCE OF THE PUBLIC UTILITIES OF THE UNITED STATES AND CANADA IN THE USE OF THE SCHÄFER PRONE PRESSURE METHOD OF RESUSCITATION IN CASES OF ELECTRIC SHOCK*

IN 1922, Mr. Samuel Insull, President of the Commonwealth Edison Company, Chicago, Ill., provided a medal which was to be awarded by the National Electric Light Association as an expression of merit in cases of successful resuscitation from electric shock by the Schäfer prone pressure method. The announcement of this sponsorship and award was made at the Annual Convention of the National Electric Light Association in 1922. This generous provision by Mr. Insull is largely responsible for the wide public interest in the subject and for the general confidence in the prone pressure method.

The Canadian Electrical Association Resuscitation Medal was offered through the generosity of Mr. Julian C. Smith, President of the Shawinigan Water & Power Company, and Mr. A. Monro Grier, K.C., President of the Canadian Niagara Power Company. The medal is presented in the name of the Canadian Electrical Association on action by their Executive Committee. The metal used in preparing the bronze for the medals came from the wire which formed the first transmission line of the North Shore Power Company between St. Narcisse and Three Rivers in the Province of Quebec, the first high tension line in the British Empire.

The conditions under which both the Insull and the Canadian medals are awarded are virtually the same, so that it is sufficient to give only those for the Insull Medal (see p. 118).

It should be noticed (Condition 4) that awards are made to employees of member companies of the National Electric Light Association only (physicians excluded) and *not* to members of the general public. Furthermore, awards are made (Condition 1) only in cases where the Schäfer prone pressure method has been applied. The victim may be either a public utility employee or a member of the general public. The Canadian Electrical Association Resuscitation Medal, however, is open to any employee of a public utility in Canada and may be awarded for resuscitation by other means than the Schäfer prone pressure method.

Copy of the report form which must be filled in (for the Insull Medal) and

* A Report by the Engineering Committee of the Conference on Electric Shock:
Cecil K. Drinker
Oscar H. Fogg
Arthur E. Kennelly
John W. Lieb
Wills Maclachlan
Charles B. Scott
Louis A. Shaw
Robert M. Thomson
Philip Drinker, Chairman.
Received for publication Jan. 12, 1928.

Plans for Award of the Insull Medal

1 After a case of successful resuscitation, the person who performs it, or the Company, shall as soon as possible thereafter, report the case to the Accident Prevention Committee in the Geographic Division in which the resuscitation took place. Such report shall contain details as to time, place, voltage of conductor, time required to restore patient to consciousness, opinion of witnesses or physicians as to the extent of suspended animation, and such other information as will enable the Committee to intelligently pass upon the merits of the case.

2 The Accident Prevention Committee in the Geographic Division shall investigate the case and make recommendations either for or against the awarding of the medal.

3 These recommendations shall be sent to the Accident Prevention Committee of the National Electric Light Association, a copy of the report being sent to the Executive Committee of the Geographic Division.

4 The Accident Prevention Committee of the National Electric Light Association shall review the case and obtain further information, if necessary, and make decision as to whether or not a medal shall be awarded in the particular case, and shall report each case and its findings thereon to the Executive Committee of the National Electric Light Association, transmitting therewith the Committee's recommendations as to the time and place selected for the presentation of the medal.

5 The Accident Prevention Committee, after making such report to the Executive Committee of the National Electric Light Association and receiving the approval of the Executive Committee, shall then arrange with the applicant, the Executive Committee of the National Electric Light Association, the Accident Prevention Committee of the Geographic Division and Mr. Samuel Insull as to the time and place at which the presentation is to be made.

6 The medal shall be awarded in meritorious cases of resuscitation from electrical shock by the Schafer Prone Pressure Method to employees of member companies of the National Electric Light Association.

7 The medal shall be presented by Mr. Samuel Insull or his appointee.

8 A suitable certificate, describing the accident and service rendered, shall be presented with the medal, the same to be signed by the President of the National Electric Light Association.

Conditions Governing the Award of Insull Medals

1 No award shall be made for resuscitation by any method other than the Schafer Prone Pressure Method.

2 No award shall be made for resuscitation from suspended breathing caused by gas poisoning, gas asphyxiation, drowning or any cause other than electrical shock.

3 Physicians are not eligible for Insull Medal Awards under these rules.

4 Any employee of a member company of the National Electric Light Association is eligible for an award of the Insull Medal, who has by the Schafer Prone Pressure Method of Resuscitation restored natural breathing to a person who has succumbed to suspended respiration as a result of electrical shock and who has by the prompt and intelligent application of this method prevented the death of such person from suspended respiration due to electrical shock.

5 In cases where the person has been so resuscitated and after an appreciable lapse of time succumbs from other causes such as burns or bodily injury, awards will be made the same as though the person had survived.

6 In certain cases, an employee who had assisted in a successful resuscitation may be commended by letter signed by the Chairman of the Committee.

7 In certain cases of resuscitation more than one person may be eligible for an award if the circumstances are such as to fully justify the award to each applicant.

Note A: The employing company shall in all cases involving more than one claim, make a careful and thorough investigation and satisfy itself, if possible, as to the one person who is entitled to the award of a medal and the other or others in whose behalf applications for other forms of recognition might be made.

Note B: In case of doubt as to the merits of claims for an award, or as to whether more than one award should be given in any one case, the matter shall be finally decided by the Accident Prevention Committee of the National Electric Light Association.

8 All applications must be signed by an authorized representative of the employing company.

Application Filed..... Application No.....

National Electric Light Association

29 West 39th Street, New York City

APPLICATION FOR INSULL MEDAL

IN BEHALF OF.....

COMPANY AFFILIATION.....

A—DESCRIPTION OF ACCIDENT

1. Name of person injured..... Age.....
2. Residence address.....
3. Employing company.....

.....

4. Occupation of injured.....
5. Place of accident.....
6. Date..... Time.....
7. What was injured doing when accident occurred.....

.....

7a. Was this his regular work.....

7b. How long had injured been performing this particular kind of work.....

8. Voltage of circuit involved.....
9. Name of person in charge of work being done by injured.....
10. Where was person in charge at time of accident.....

.....

11. Cause of accident.....
12. Any other details of accident not included in above.....

.....

B—DESCRIPTION OF RESUSCITATION

1. Name of person who first cleared patient from circuit.....

..... Address.....

2. Occupation..... Employer.....
3. What was condition of patient when discovered.....
4. How was patient cleared from circuit.....
5. Name of person who first performed resuscitation on patient.....

..... Address.....

6. Occupation..... Employer.....
7. How many minutes after receiving shock was resuscitation started.....
8. How long was actual resuscitation carried on before there were any signs of life.....

9. How long was resuscitation carried on before patient breathed without assistance.....

10. Names and addresses of other persons who performed resuscitation.....

.....

.....

10a. Names and addresses of persons who rendered other assistance.....

.....

.....

10b. Names and addresses of other witnesses.....

.....

11. General details of assistance rendered by such persons.....

.....

.....

.....

11a. State reasons why it was necessary for more than one person to perform resuscitation.....

.....

12. Name or names of doctor or doctors in attendance with addresses.....

.....

.....

13. Description of first aid treatment rendered by doctor.....

.....

.....

14. Where was patient taken after accident.....

.....

15. Mode of transportation of patient.....

16. Give any further information in connection with resuscitation or treatment not included in above.....

.....

17. What method of resuscitation was used.....

18. Whom do you consider rendered the most conspicuous service in resuscitating the patient.....

.....

C—DESCRIPTION OF AFTER TREATMENT

1. Description of injuries.....

.....

2. Description of treatment of electrical shock.....

.....

3. Description of treatment of burns.....

4. Exact or probable duration of lost time due to accident.....

J. I. H.
April, 1928

5. Description of permanent disability if any as result of accident.....

6. If patient died within a few hours or days of accident, attach copy of death certificate and statement of attending doctor.

Subscribed and sworn before me

This.....day of.....192.....

.....
Notary Public

Signature.....

Title.....

Company.....

Address.....

NOTE—Application to be signed by an authorized representative of the employing company

---

Kindly give sketch or photograph describing accident

Application No.....

TO BE FILLED IN BY
ACCIDENT PREVENTION COMMITTEE

In connection with the foregoing accident and successful resuscitation by the Prone Pressure Method, I would recommend that the Insull Medal be awarded to.....

.....

.....

Signature..... Chairman, Accident Prevention Committee

Date..... .....Geographic Division

Approved:

..... Date.....

..... Date.....

..... Date.....

Insull Medal Awards Subcommittee,
National Accident Prevention Committee

Approved:

..... Date.....
Chairman, National Accident Prevention Committee

Approved: Executive Committee, N. E. L. A. Date.....

.....
Secretary N. E. L. A.

MEDAL AWARD

Insull Medal was presented to.....

Date..... Place.....

By whom.....

sworn to before a notary public before it can be entered for a medal award is given on pages 119 to 121.

Analysis of Data from Official Records

Through the courtesy of the National Electric Light Association and the Canadian Electrical Association, we have been privileged to study their official records in connection with these awards. We have obtained also, by questionnaire, reliable data on a number of fatal cases of electric shock. Although these cases represent only a portion of those which have occurred in the United States and Canada over the years covered, they are authentic and the reports on each one have been carefully examined. The two sets of data we have analyzed as follows:

1. Cases of electric shock in which resuscitation was carried out by the prone pressure method and the victim lived—200 cases, or 76 per cent.

2. Cases of electric shock in which resuscitation was carried out but failed to restore breathing and the victim died, no other cause of death being apparent except that directly resulting from electric shock—sixty-five cases, or 24 per cent.

An analysis of these two groups according to the years in which the cases occurred gave the following results:

Year	*Successful Cases*	*Fatal Cases*
1918	..	2
1919	..	2
1920	2	1
1921	1	5
1922	12	4
1923	14	3
1924	27	2
1925	43	3
1926	55	10
1927	46	31
1928	..	2
Total	200	65

The 200 cases in which resuscitation was successful have been further analyzed from various aspects.

Comparison by Months

Month	*Total Cases No.*	*Successful Cases No.*	*Successful Cases %*
Jan.	13	9	69
Feb.	17	14	82
March	13	9	69
April	13	9	69
May	32	24	75
June	39	34	87
July	28	14	50
Aug.	36	29	81
Sept.	22	16	73
Oct.	22	15	67
Nov.	17	15	88
Dec.	13	12	92
Total	265	200	76

It is interesting to note that the greatest variation occurs in the middle of the summer—the drop from 87 per cent. in June to 50 per cent. in July, and the return in August to 81 per cent.

Comparison by Hours

Hour	*Total Cases No.*	*Successful Cases No.*	*Successful Cases %*
7– 8 A.M.	10	8	80
8– 9	13	10	77
9–10	24	18	75
10–11	27	21	78
11–12 M.	34	26	77
12– 1 P.M.	7	5	71
1– 2	19	16	84
2– 3	39	30	77
3– 4	30	21	70
4– 5	22	16	73
5– 6	16	14	88

Hour	Total Cases No.	Successful Cases No.	Successful Cases %
6– 7	9	6	67
7– 8	6	5	83
8– 9	2	2	100
9–10	3	2	67
10– 7 A.M.	2	0	0
No time	2	0	0
Total	265	200	76

Comparison by Voltage

Voltage	Total Cases No.	Successful Cases No.	Successful Cases %
0–749	34	25	74
750–4,999	115	79	69
5,000–39,999	89	74	83
40,000 and over	20	18	90
Induced current	4	3	75
None given	3	1	33
Total	265	200	76

It will be noted that there is a greater percentage of successful cases at the higher voltages.

Comparison by Duration of Contact

The cases were divided into two classes: (1) those who *fell clear* from the contact; and (2) those who were *cleared by other means.* It was arbitrarily assumed that the duration of contact would be shorter if the victim fell clear than if he were cleared by other means.

	Total Cases No.	Successful Cases No.	Successful Cases %
Fell clear	169	132	78
Other means	96	68	71
Total	265	200	76

Comparison of Speed with Which Resuscitation Was Applied

Analysis of the total group of 265 cases according to the interval between the shock and the application of resuscitation shows that among 202 cases in which resuscitation was applied within three minutes after the shock 158, or 78 per cent., were successful; among sixty-three cases in which over three minutes had elapsed forty-two, or 67 per cent., were successful.

Time of Resuscitation

Neglecting all cases in which resuscitation had to be carried on for more than forty-five minutes, the average time for resuscitation from shock at the following voltages was:

Voltage	Min.
0–749	17
750–4,999	17
5,000–39,999	17
40,000 and over	11
Induced current	17
None given	20

One would therefore be led to believe that the average case of resuscitation takes from fifteen to twenty minutes. The following cases should, however, be noted:

Voltage	Hrs. / Min.
0–749	1 / 30
	2 / —
	1 / —
	1 / —
	2 / —
750–4,999	1 / 30
	1 / —
	1 / —
	2 / 5
	— / 54
	1 / —
5,000–39,999	— / 50
	1 / —
	1 / —
	2 / 30
	2 / 30
	8 / —

The average time for resuscitation in all the 200 cases under consideration was twenty-four minutes.

In three cases, the victims' bodies were reported as "rigid." In practically all cases, the resuscitators reported that the victims were "unconscious and not breathing." It is of interest to find that, of the cases reported in the United States, twenty-seven victims were able to breathe without assistance within eight minutes after artificial respiration had begun. As the times were estimated rather than measured in these cases, the accuracy of the "time-interval" analyses is questionable.

Respiratory and Cardiac Failure

Dr. W. B. Cannon pointed out to us that it may be significant that most of the victims were reported as "unconscious and not breathing." In view of their ultimate recovery, this seems to point toward respiratory failure without the additional complication of cardiac failure such as might be caused by ventricular fibrillation. In cases of the latter type, the victim sometimes retains consciousness for several minutes, perhaps; he may be breathing and able to speak when found. In the unconsciousness which follows this condition, artificial respiration is then usually of no avail.

Conclusions

Although our data are limited to 265 cases, it is interesting to note that there are certain points of agreement with known laboratory results on animals:

1. That the duration of contact with the current decides to a great extent whether or not the resuscitation will be successful.

2. That immediate application of resuscitation after electric shock is extremely important.

3. That it will be worth while to continue the publication periodically of authenticated reports of cases of electric shock, both fatal and non-fatal.

Use of Prone Pressure Method

The following estimate of the number of persons who are instructed annually in the Schäfer method is based mainly upon reports as to the number of published texts (illustrated manuals) distributed in the United States and Canada, together with the degree of utilization of such distribution. Utilization by public utilities is not confined to their employees, but usually extends to employees of other industries and to the public as well. While the estimate may properly be questioned, it reflects a careful consideration of the most authentic information available:

Through National Electric Light Association and its membership	160,000
Through American Gas Association and its membership	75,000
Through other sources (including National Safety Council, Boy Scouts of America, Red Cross, government organizations, police and fire departments)	165,000
Total instructed in United States	400,000
Total instructed in Canada	125,000
Total	525,000

J. I. H.
April, 1928

As a result of their wide practical experience, the public utilities in the United States and Canada have unanimously condemned mechanical respiration devices and technic in the use of which an appreciable amount of time passes before artificial respiration is applied. A delay of minutes or even of seconds has frequently been shown to determine whether the outcome is recovery or death.

The simplicity of the Schäfer method and the promptness with which it is applied have caused it to displace the lungmotor, pulmotor, and similar devices, which are now condemned for use in resuscitation from electric shock or gas poisoning. The only occasions on which such devices are used today by the public utilities are, paradoxically enough, when they are demanded by the attending physician. The average physician (who is quite properly called in) is apt to disclose a surprising ignorance of modern resuscitation methods and technic.

Long-continued respiration by the Schäfer method is very fatiguing to the operator and sometimes dangerous to the victim, especially when the operator is inexperienced. The fatigue of even trained operators is witnessed by the fact that three men normally compose a "rescue squad," each man working for twenty minutes and resting for forty. It is by this means that artificial respiration is applied continuously for long periods.

Standard Technic for Artificial Respiration by the Prone Pressure Method

The standard technic which is now recommended both in the United States and in Canada is as follows:[1]

1. Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face turned outward and resting on hand or forearm so that the nose and mouth are free for breathing. (See Fig. 1.)

2. Kneel, straddling the patient's thighs with your knees placed at such a distance from the hip bones as will allow you to assume the position shown in Figure 1.

Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position, and the tips of the fingers just out of sight. (See Fig. 1.)

3. With arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing. (See Fig. 2.) Do not bend your elbows. This operation should take about two seconds.

4. Now immediately swing backward so as completely to remove the pressure. (See Fig. 3.)

[1] As a result of many meetings and most careful discussion, this standardized text describing the Schäfer prone pressure method of artificial respiration was recently agreed upon at a meeting held under the auspices of the United States Public Health Service, Washington, D. C., by the following interested organizations: American Gas Association, American Medical Association, American Red Cross, American Telephone & Telegraph Company, American Public Health Association, National Electric Light Association, National Safety Council, United States Army, United States Navy, United States Bureau of Mines, United States Bureau of Standards, United States Public Health Service, Bethlehem Steel Corporation.

FIG. 1.—Patient and operator in position; operator's hands correctly placed, lightly touching patient's back.

FIG. 2.—Operator bringing pressure on patient's back.

FIG. 3.—Pressure entirely removed; operator in relaxed position.

5. After two seconds, swing forward again. Thus repeat deliberately twelve to fifteen times a minute the double movement of compression and release, a complete respiration in four or five seconds.

6. Continue artificial respiration without interruption until natural breathing is restored, if necessary, four hours or longer, or until a physician declares the patient is dead.

7. As soon as this artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest, or waist. *Keep the patient warm.* Do not give any liquids whatever by mouth until the patient is fully conscious.

8. To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, he should be given some stimulant, such as one teaspoonful of aromatic spirits of ammonia in a small glass of water or a hot drink of coffee or tea, etc. The patient should be kept warm.

9. Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. He should not be moved from this point until he is breathing normally of his own volition and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time that he is being moved.

10. A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched and if natural breathing stops, artificial respiration should be resumed at once.

11. In carrying out resuscitation it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

The prone pressure method of artificial respiration described in these rules should be used in cases of suspended respiration from all causes—drowning, electric shock, carbon monoxide poisoning, injuries, etc. Delay of even one minute in the application of the method may lose a life. Follow the instructions even if the patient appears dead. Continue artificial respiration until natural breathing is restored or until a physician declares rigor mortis (stiffening of the body) has set in. Success has come after *eight hours* of effort.

BOOK REVIEWS

THE PRINCIPLES OF SANITATION. A PRACTICAL HANDBOOK FOR PUBLIC HEALTH WORKERS. By *C. H. Kibbey,* Director of Sanitation, Tennessee Coal, Iron and Railroad Company, Birmingham, Ala., Birmingham Southern Railroad Company, Birmingham, Ala., Fairfield Utilities Company, Fairfield, Ala.; etc. Cloth. Pp. 354 with illustrations, bibliography, and index. Philadelphia: F. A. Davis Co., 1927.

During fifteen years as director of the sanitation division of an industrial health department the author employed many sanitary inspectors, "perforce, without reference to, and for every other reason than because of, training and experience." This book is the outgrowth of a series of lectures given in weekly classes of instruction in an attempt to bring to this group of nontechnical men a knowledge of the cause of disease together with means of its prevention.

The subject matter is divided into five sections: I. Diseases Spread through Discharges from the Intestinal Tract; II. Diseases Spread Largely or Entirely through Secretions from the Mouth and Nose; III. Modern Methods of Rural Sanitation; IV. An Analysis of Food in its Relation to Disease; V. A Study of the Prevention of Occupational Diseases.

Chapter I deals with general considerations. Sanitation is defined, and a glossary of technical terms, designed to familiarize the nontechnical worker with the vocabulary of the bacteriologist and the epidemiologist, is included. Three chapters are devoted to the so-called filth-borne diseases. These diseases are discussed under the headings: causation, transmission, carriers, incidence, and prevention. The respiratory infections are treated in eleven chapters. Measles, scarlet fever, diphtheria, whooping cough, mumps, epidemic cerebrospinal meningitis, smallpox, influenza, lobar pneumonia, and acute coryza are included in this section.

Under modern methods of rural sanitation are included: disposal of waste products, water, milk, immunity, fly control, malaria and its control.

Section IV deals largely with vitamins, ptomain poisoning, pellagra, and food adulteration.

In the last section the question of occupational diseases is considered. Specific occupational diseases and occupational infections are treated separately.

In a book of this size a subject as broad as "The Principles of Sanitation" must necessarily be condensed and only material of first importance to the reader for which the book was prepared should be presented. The large amount of space devoted to the respiratory diseases, and in particular to such diseases as influenza, pneumonia, and common colds, seems somewhat out of proportion to their importance so far as the sanitary inspector is concerned. The question of rural water supplies, on the other

hand, is of first importance to the sanitary inspector, yet one fails to find any information on the use of disinfectants such as hypochlorite or liquid chlorine.

Fly and mosquito control are well presented. Of particular interest is the author's description of his experiments on fly control through the use of manure pits and the subsequent development of concrete manure storage bins. It was found that after storage for a period of six weeks the manure is so changed, owing to fermentation, that *flies will not breed in it.*

To the sanitary inspector the problem of food sanitation is largely one of providing sanitary facilities for its production such as slaughter houses, sanitary kitchens, and the like. The author, however, touches only indirectly on these problems in the section on foods. On the other hand, he discusses at some length food vitamins and pellagra, questions of greater interest to the public health nurse and physician than to the inspector.

Specific occupational diseases are discussed in a general way. The etiology of each disease is discussed, industries in which it occurs are listed, and methods of prevention are touched upon. The reviewer fails to find any reason for including "Changed Atmospheric Pressure" under the occupational infections.

This book is not intended for the technically trained worker and he will find little new information in it. Like many other books intended for the sanitary inspector, it is largely a non-technical review of current literature brought together for his convenience. —*T. F. Hatch.*

DIE BESEITIGUNG DER BEIM TAUCH- UND SPRITZLACKIEREN ENTSTEHENDEN DÄMPFE. Im Auftrag des Technischen Ausschusses der Deutschen Gesellschaft für Gewerbehygiene bearbeitet. By *Wenzel*, Oberregierungs- und Gewerberat in Berlin; *Alvensleben*, Oberingenieur in Berlin; and *Witt*, Gewerberat in Neuss. Paper. Pp. 35 with illustrations. Schriften aus dem Gesamtgebiet der Gewerbehygiene, N. S. No. 18. Berlin: Julius Springer, 1927.

America leads in the production and use of nitrocellulose coatings, but they have been introduced into Europe and with them goes the use of spraying and dipping instead of brush work. These new methods are used especially in the metal industries, in coating machinery and vehicles, furniture and pianos. It is questionable if precautions for the safeguarding of the workers have developed as fast as has the industry. Such precautions might be based on the technic followed in coating and on the composition of the lacquer that is used, but both these features present an endless variety, each installation is a special problem, and new and unknown mixtures are introduced every day. There is also a great increase in the fire hazard brought about by the new method. To deal with the problem a committee was appointed by the technical branch of the German Society for Industrial Hygiene to study the methods of fume removal and to make recommendations. The three members of the committee—Wenzel, Alvensleben, and Witt—have now published their report with an introduction by Leymann, one of the best known German experts in industrial hygiene.

The committee made no attempt to test the physiologic effects of the different solvents, but assume that all fumes must be removed. They con-

sider this a practical necessity because the coating is usually of unknown composition and the constituents are likely to vary without any warning to the user. They refuse to pronounce any one method of fume control as best because of the wide variety of processes necessitated by the variety of goods to be coated, and therefore confine themselves to describing methods actually in use and commenting on them. One must take into consideration the size and shape of the surface to be coated and the fact that the fumes may be heavier than air. The worker must be protected against drafts and against too great a difference in the temperature of the outgoing and incoming air. It is also necessary to keep exhaust pipes from clogging, and electric sparks which might cause explosion must be guarded against. Dipping is best done in a closed apparatus having windows and outside control, or on a traveling belt passing through the tank and under a drying hood. Spraying needs exhaust ventilation, even more, for the lacquer is thinner and is atomized into a mist by the pressure in the gun which is from 30 to 45 pounds. It can usually be assumed that for each cubic meter of air space in the cabinet, 20 to 30 cu.m. of the spray and air mixture must be removed each minute; for this it is sufficient to have an air velocity of 10 to 15 meters per second in the suction pipe, and of 1.5 to 2 meters per second at the working spot. In spraying interiors of tanks, stills, ship cabins, etc., the man must also wear a respirator; it must be remembered, however, that respirators are for emergency only and the worker must not be expected to wear one all day, but only for a short period. The respirator should be not a filter, but one with positive air pressure.

Many technical difficulties remain, although in some industries the problems have already been satisfactorily solved. It is of the greatest importance that the expert on such a job should know what solvents are present in the lacquer and be assured against their sudden unannounced alteration by the manufacturer. The coatings are of three varieties—oily, alcoholic, and nitrocellulose. The oily consist of linseed or cottonseed or Chinese wood oil, with natural resins or artificial, such as bakelite; but the latter needs the addition of benzol, solvent naphtha, or benzine. The alcohols used are denatured ethyl, propyl, amyl, and methanol. The nitrocellulose coatings, or Zapon lacquers, consist of nitrocellulose, which is harmless, and solvents, which are chiefly esters or ketones, and thinners, such as benzol or benzine. The esters are amyl or butyl acetate or the less volatile, but more toxic, cyclohexanol acetate. The ketone generally used is acetone, but carbon tetrachloride or chloroform or tetrachlorethane or trichlorethylene may take its place. The physiologic action of these solvents is chiefly on the central nervous system, but there is also irritation of the respiratory mucosa and of the conjunctiva, while some have a specific action on liver or kidney or eye or brain.

Some interesting suggestions are made. For instance, they are experimenting with a cabinet which will have 75 cu.m. of air per minute forced through a muslin ceiling, and an exhaust drawing 200 cu.m. per minute through a slotted floor, so that the

paint mist is always forced downward. The most recent experiments are aimed at preventing the formation of mist and lessening the use of compressed air, either by lowering the pressure in the spray gun (now usually from 30 to 45 pounds) and increasing the negative pressure in the cabinet, or by discarding compressed air altogether. This last would make spraying available in small establishments and greatly extend its use. The committee believe that they are on the threshold of an unexampled development in this field. —*Alice Hamilton.*

FINAL REPORT OF THE COMMITTEE, CHEMICAL SECTION, NATIONAL SAFETY COUNCIL, ON SPRAY COATING. Paper. Pp. 53 with illustrations, appendixes, and tables. Chicago: National Safety Council, Sept., 1927.

The primary objective of this study was the "detection of benzol poisoning, plumbism and silicosis and *their prevention*" in spray coating.

The Report is divided into three parts. The first consists of a summary and conclusions of the findings of the field and laboratory studies; the second (Appendix I) of a detailed field study by Dr. H. F. Smyth and co-workers on benzol and lead poisoning and on silicosis from spraying lacquers and vitreous enamels; the third (Appendix II), by S. H. Katz and co-workers, is on the efficiencies of respirators filtering lead paint, benzol, and vitreous enamel sprays. Finally there is a one-page summary of the Minority Report in which exception is taken to certain of the conclusions of the majority of the Committee.

"Throughout the study the effort was made to observe conditions existing in the industries which were being examined, to determine the degree of atmospheric pollution in the air breathed by the operator and to correlate as far as possible these engineering and chemical findings with the actual condition of the operatives as revealed by careful clinical examination and by refined blood tests and examinations of body discharges. Altogether 29 different plants (or groups of workers) were studied. Eighty-six air tests were made for benzol, 27 for lead and 33 for silica. A total of 354 physical examinations were made, including 349 blood tests.

"The field work was completed by September, 1926. On October 18 the Committee held its third meeting to hear Dr. Smyth's preliminary report (which was also presented informally at the Detroit Safety Congress in October). During the winter the results were analyzed in detail and a report drafted. This report with the comments made by members of the Spray Coating Committee was submitted to an Editing Committee. Their final draft was considered by the Spray Coating Committee and, with modifications, was finally approved and adopted at a meeting held on June 6, 1927."

Accepting a white cell count below 5,625 per cubic millimeter as index of latent benzol poisoning, the Committee believes that "the spraying of benzol lacquers with the spray gun constitutes a real health hazard under the conditions found by Dr. Smyth." In the case of lead as a spray coating hazard, the Committee concludes that "the lead poisoning hazard in spray coating as at present conducted in

the industrial plants examined is a distinctly significant one." In this case, its conclusions resulted mainly from physical examination and analyses of feces of workmen subjected to varying exposures. The Minority Report of the Committee takes exception to these conclusions, claiming with some gruffness that "the conclusion of the committee as to air velocity with respect to lead paints seems only a guess." This conclusion was, essentially, that air velocities from the suction fans of about 150 feet per minute or more are probably needed across the face of the spray booth in order to give the workmen adequate protection. As the field and experimental data (*viz.*, concentrations of lead in air) presented in the case of lead are meager, the objection of the minority seems pertinent.

The silica hazard in spraying vitreous enamels was less definite but was certainly indicated from the physical examinations. Lack of data and of subjects weakens the argument for condemning the spraying of vitreous enamels, but, on the other hand, the argument presented by the minority on this item is unconvincing.

As the result of field tests and of tests made in an experimental spray coating booth, air velocities for all types of spray coating of 200 feet per minute are suggested, the minority again dissenting and recommending velocities of 90 feet per minute as the minimum.

The question of the optimum pressure at the spray gun and the effect of varying air pressures on air pollution, particularly by lead, is but slightly touched upon. On page 26, Dr. Smyth states:

> In analyzing the air tests for lead it was noted that the air pressure at the gun on the fluid being sprayed had a decided influence on the amount of lead in suspension in the air sampled. No negative results were obtained with gun pressures of over 95 pounds while only two out of six tests with pressures under 90 pounds were positive, one of these being the minimum amount detected by the method employed. These results are given in Table M.

This table gives results with pressures of 85, 90, 95, 100, and 105 pounds per square inch. Apparently no studies were made at lower pressures, although their use has been advocated as a means of reducing air pollution.

In view of the conflicting opinions on the ventilation required in the spray booths for the avoidance of the lead, benzol, or silica hazard, the clause quoted from the report of the Industrial Commission of Wisconsin is of interest:

> In some instances an average flow of 200 cubic feet per minute per square foot of booth face area was found none too much for effective protection, and in other cases as low as 80 cubic feet per minute was found equally effective.

The section on respirators (Appendix II), while no less unpopular with the minority, is concise and well presented. Essentially, the conclusions in regard to respirators are that hose masks should be used and that respirators working on the filtration principle are impractical except for emergency work. These statements apply equally to protection against benzol, lead, and silica. When one discovers that the Committee desired a respirator 99.95 per cent. efficient against silica and another about 99.7 per cent. efficient against lead, this is

not surprising, for these specifications preclude the use of any reasonably cheap and comfortable industrial respirator.

As its most important conclusion, the Committee recommends that "manufacturers of paints, lacquers, shellacs, varnished and vitreous enamels to be used in spray coating should so far as possible eliminate benzol, lead and free silica from their products and where this has been done should clearly label such products as containing less than a certain maximum amount of lead or benzol or free silica as the case may be; and that employers using the spray gun for indoor and booth work should so far as possible insist on obtaining and using only materials so labeled."

One is impressed by the vast amount of work which has gone into the preparation of this Report and by the useful data which are thus made available, but it is regrettable that the presentation of this material is not always satisfactory. The "Figures" are literally scattered through the report with no particular reference to the context: Figure 5, for instance, is placed on page 13 when it belongs on page 46, and Figures 1 and 2 on page 9 when they belong on page 20. One of Dr. Katz' plots (an important one) occurs in Dr. Smyth's article, with which it has no connection. Photomicrographs, presumably of dust particles, cited in Dr. Katz' article, are omitted without comment.—*Philip Drinker.*

BOOKS RECEIVED

Books received are acknowledged in this column, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers and as space permits.

FEDERAL HEALTH ADMINISTRATION IN THE UNITED STATES. By *Robert D. Leigh*, A. Barton Hepburn Professor of Government, Williams College. Cloth. Pp. 687 with notes, bibliography, and index. New York and London: Harper & Brothers, 1927.

JUVENILE EMPLOYMENT AND LABOR MOBILITY IN THE BUSINESS CYCLE. By *Maurice Beck Hexter*, Ph.D., Executive Director, Federated Jewish Charities of Boston, Instructor in Social Ethics, Harvard University. Cloth. Pp. xix, 111 with tables and charts. Boston: Massachusetts Child Labor Committee, 1927.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN. Edited by Geh. Med.-Rat Prof. Dr. *Emil Abderhalden*, Direktor des Physiologischen Institutes der Universität Halle a. d. Saale. Abt. V, Methoden zum Studium der Funktionen der einzelnen Organe des tierischen Organismus, Teil 5A, Heft 3. Methoden der Muskel- und Nervenphysiologie. Lieferung 235. Paper. Pp. 391–574 with illustrations. Berlin and Vienna: Urban & Schwarzenberg, 1927.

This section of Abderhalden's Handbuch consists of four parts, as follows:

"Die photomyographische Methode nach Bethe-Happel." By Paul Happel. Pp. 391–414.

"Methoden zur Untersuchung der Veränderungen der Reizbarkeit und Leitungsfähigkeit im Elektrotonus." By Otto Weiss. Pp. 415–426.

"Methoden der Arbeitsphysiologie unter besonderer Berücksichtigung des

Problems der gewerblichen Ermüdung." By Edgar Atzler. Pp. 427–558.

"Methode zur Bestimmung der auf die einzelnen Sohlenbezirke wirkenden Teilgewichte des menschlichen Körpers." By Adolf Basler. Pp. 559–574.

Fifth International Medical Congress for Industrial Accidents and Occupational Diseases

Budapest, September 2 to 8, 1928

The Executive Committee of this Congress consists of the following: President, Dr. Tibor de Verebély, Professor at the University; Vice-President, Dr. William de Friedrich, Professor at the University; Secretary-General, Privatdozent Dr. George Gortvay, Section Chief.

The National Committee for the United States has been created and consists of the following: Dr. Volney S. Cheney, Chicago; Dr. R. W. Corwin, Pueblo; Dr. Eugene L. Fisk, New York; Dr. Otto P. Geier, Cincinnati; Dr. Leonard Greenburg, New Haven; Dr. George M. Kober, Washington, D. C.; Dr. W. J. McConnell, Philadelphia; Dr. Lloyd Noland, Birmingham; Dr. Francis D. Patterson, Philadelphia; Dr. George M. Price, New York; Dr. Frank L. Rector, Chicago; Dr. Wm. A. Sawyer, Rochester; Dr. Henry F. Smyth, Philadelphia; Dr. C.-E. A. Winslow, New Haven; and Dr. Emery R. Hayhurst, Columbus, *Chairman*.

Addresses already scheduled by various prominent Europeans include the following: Prof. J. Liniger, Frankfurt a. M.; Dr. F. Zollinger, Aarau; Prof. K. B. Lehmann, Würzburg; Sir Thomas Oliver, London; Prof. J. G. Sleeswijk, Delft; Prof. Jötten, Münster; Prof. Koelsch, München; Prof. Julius van der Hoeve, Leiden; Prof. Dr. Stephan Jellinek, Wien. Also lectures are scheduled to date by the following: Prof. Salvatore Diez, Roma; Dr. C. Poenaru Caplescu and Dr. Presbeanu, Bukárest; Prof. Theodor Sommerfeld, Berlin; Dr. Lorenz Böhler, Wien; Prof. Dr. Quensel, Leipzig; Prof. Dr. C. Marcus, Breslau; Prof. Dr. Molineus, Düsseldorf; and Sanitätsrat Dr. Alfred Peyser, Berlin-Charlottenburg.

Addresses and lectures are wanted from American physicians, dentists, and other specialists in the field. Such are requested to get in touch with the Chairman for the National Committee for the United States, Dr. Emery R. Hayhurst, Hamilton Hall, Ohio State University, Columbus, Ohio. General invitation is also extended to attend the Congress which will be arranged so as to coordinate with the Deutscher Naturforscher Tag to be held in Hamburg, and the Orthopädenkongress to be held at Prague during the month of September, 1928.

Fourth International Session of the Permanent International Committee on Occupational Diseases

Lyons, April 3 to 6, 1929

The questions on the agenda of the Session are as follows:

1. Silicosis (three reports: etiology, clinics, and legislation); a general report dealing with forms of pneumonokoniosis.
2. Cataract of occupational origin (two reports: etiology and clinics).

J. I. H.
April, 1928

3. Endocrine system and forms of poisoning (it is intended to furnish under this heading a single report to be intrusted to three experts).

4. Communications relating to results of inquiries so far unpublished.

Finally, if it is found advisable to include another question on the agenda, the subject chosen will be the problem of occupational disease statistics.

Prof. Etienne Martin, of the Institute of Legal Medicine of Lyons, in collaboration with Professors Agasse-Lafont and Kohn-Abrest of Paris, with the approval of the executive will designate the experts selected to present reports on the subjects before the Session.

Requests for all further information should be addressed to Monsieur le Prof. Etienne Martin, or to the Secretariat of the Committee, Hygiene Service, International Labour Office, Geneva.

List of Members

Present Members	*Members Proposed*
President (Italy) Prof. Devoto (Milan) President	
Prof. Pieraccini (Florence) Vice-President	
Prof. Biondi (Siena)	
Prof. Monti (Pavia)	
Dr. L. Carozzi (Geneva) Secretary	
Dr. Vigano (Milan) Treasurer	
France Deceased	Prof. Martin (Lyons) Prof. Agasse-Lafont (Paris) Prof. Kohn-Abrest (Paris)
Belgium Dr. D. Glibert (Brussels)	Prof. Malvoz (Liège) Dr. Stassen (Liège) Prof. Hermans (Mons)
Netherlands Deceased	Dr. Heyermans (Amsterdam) Dr. Kranenburg (The Hague)
Great Britain Sir Thomas Oliver (Newcastle) Sir Thomas Legge (London)	Prof. Collis (Cardiff) Prof. Prosser-White (Manchester) Dr. Bridge (London)
Germany Prof. Hahn (Berlin) Prof. Teleky (Düsseldorf) Prof. Holtzmann (Karlsruhe)	Prof. Koelsch (Munich) Prof. Thiele (Leipzig)
Austria Prof. von Schroetter (Vienna)	Prof. Sternberg (Vienna) Dr. Brezina (Vienna)
Switzerland Deceased	Prof. Cristiani (Geneva) Prof. Zangger (Zurich)
Hungary Dr. Szegedy Maszak (Budapest)	Prof. Friedrich (Budapest)
Czechoslovakia	Prof. Loewy (Prague)
Norway	Prof. Lorange (Oslo)

List of Members (continued)

Present Members	*Members Proposed*
Russia Deceased	Prof. Kaploune (Moscow) Prof. Kagan (Kharkov)
United States of America	Dr. Alice Hamilton Prof. Hayhurst Prof. C. K. Drinker
Canada Deceased	Dr. Cunningham (Toronto)
South Africa	Prof. Mavrogordato
Australia	Prof. Robertson (Melbourne) Dr. Badham (Sydney)
Japan	Dr. Kose (Tokyo) Prof. Teruoka (Kurashiki) (Okayama)

J. I. H.
April, 1928